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Profiling Squat Assessment Among Sport Enthusiast

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ABSTRACT
Fitness has a vital role for sports enthusiast's physiological and psychological aspects. One of the fitness movements that correlate with daily activities is squats. This study aims to look at the profile of the squat assessment of gym members. Descriptive quantitative data were collected with 41 respondents (22 male, 19 female) using the purposive sampling technique, and the instrument used was a squat assessment test. The results of this study revealed that gender, age, and body mass were essential factors in power and strength during squatting movement (age: 31.64 ± 8.52 years; weight: 82.07 ± 16.79 kg), with the maximum power being male is 1849 W, and in a female subject (age: 35.32 ± 6.63 years; weight: 59.58 ± 8.05 kg) with a maximum power of 635 W. Concerning this, sports enthusiasts need to know the strength of the squat in order to ma prepare training programs.

Keywords: *Squat, Peak force, Peak power, Sport enthusiast*

1. INTRODUCTION

Regular physical activity is proven to help prevent and treat non-communicable diseases such as heart disease, stroke, and breast and colon cancers. In addition, physical activity also helps prevent other diseases such as hypertension, overweight, or obesity and can improve mental health, quality of life, and well-being[[1]. There are several ways to improve physical condition, one of them with weight training, Crossfit, functional training, calisthenic, and others. For example, weight training that is done regularly is believed to increase the strength of muscle function and is helpful to prevent injury, improve physical condition, or for health purposes.

In achieving the optimal fitness or exercise objectives, it is necessary to know the basic principles in fitness exercises that have an essential role in the physiological and psychological [2]. These exercises are the most popular in today's society. Squats are the basic movements of functional activities in daily life, exercise, and work [3].

Squats are the most commonly used endurance training for strength development, conditioning, and rehabilitation [4], [5]. Squat movements are also indirectly correlated in daily life, such as sitting, standing, holding children, lifting objects, going up and down stairs [4], [6]. Squat movement is considered an effective exercise to strengthen the muscles of the lower extremities and torso for the activation and coordination of the human motor system to maintain balance and stability [7]. Squat movements involve several muscles, including quadriceps, hamstrings, gluteus, triceps surae (gastrocnemius and soleus muscle), and lumbar erector [8].

Squat exercises are done by standing upright with your legs open and raising your hands to the side of the body. After that, one is required to bend his legs until his thighs are parallel to the ground while keeping his heel also on the ground before straightening his legs [9]. Squat exercises, apart from seeing the degree of ankle, knee, hip to improve performance, can also be used as a rehabilitation approach. Like an ankle sprain, squatting can indicate a difference between the right and left, indicating an injury to the ankle. The same applies to the angle involved in the knee because the movement is focused on flexion and extension. The knee joint movement can also be observed during squats. Several studies have used squat assessments to monitor the progress of hip replacement.

For decades, isokinetic muscle fitness tests were used to assess the strength of the quadriceps and

hamstring muscles in athletic and non-athletic [10]. Squat assessment is the most commonly used test to identify compensatory movements and consider muscles that could become overactive or less active to address muscle imbalances.

Power is the product of the force and the speed of motion. The term "velocity-force" has also been used as a synonym for force [11]. Energy production is a significant determinant of athletic success for many sports, work-related tasks, and activities of daily living [12]. The force-velocity relationship describes the impact of external forces on the muscle's speed of concentric and eccentric shortening [13].

Muscle strength deficits, such as asymmetry of the legs and the imbalance between the strength of the hamstring and quadriceps muscles, have proven essential for determining readiness to return to [14], [15]. The squat assessment shows performance results when squatting in the form of peak force, concentric peak power, mean eccentric force, concentric mean force. Peak force has two phases, namely the eccentric force and concentric force. Eccentric force and Concentric force will show the results of muscle measurement at the time of eccentric contraction is a contraction of muscle lengthening because the strength exceeds muscle strength [16]. Concentric is a muscle shortening contraction because it occurs when the pressure inside is greater than the pressure outside the body, causing muscle tension. However, the researcher will not focus on the angles produced by the ankle, knee, and hip in this study because the researcher uses a force plate that can measure the force during two phases, namely eccentric and concentric. These two phases are essential for an athlete in improving performance. Therefore, the researcher will focus on the force produced during the squat assessment through eccentric, concentric, peak force, and concentric peak force variables.

2. METHODS

2.1 Study design and participants

This study uses a quantitative descriptive design with a test to find out the strength of squat assessment. The population used in this study was 68 people. Samples were selected using purposive sampling. The total sample selected was 41 people. Forty-one participants from 2 places all-member gyms in Surabaya volunteered to participate in this study. Subjects included 22 and 19 women (age: 21 – 60 years; weight: 40 – 130 kg). All subjects were informed of the purpose of the squat assessment and procedures. They were allowed to ask any questions about the assessment.

2.2 Squat Assessment

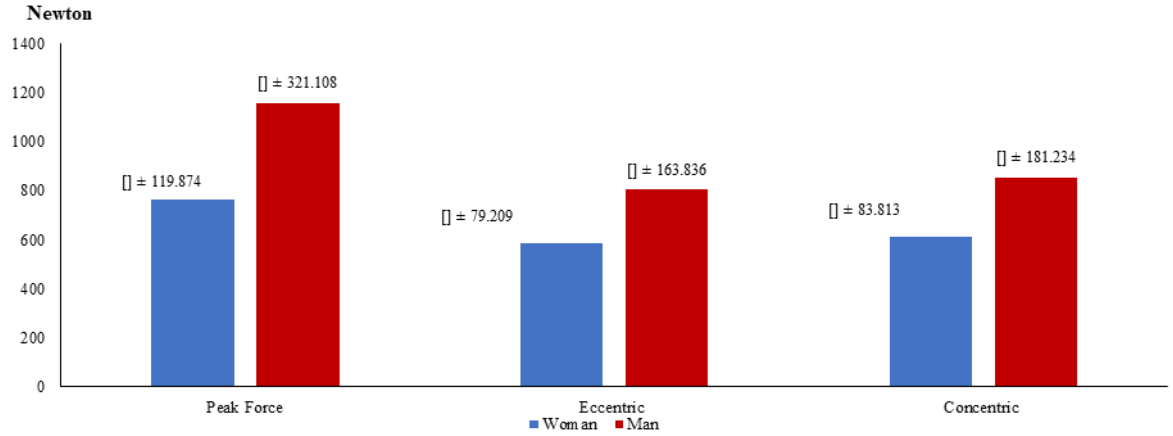

Figure 1. Result of peak force, eccentric, concentric

From figure 1, it can be seen that the highest average value is found in men with peak force, eccentric and concentric values (1160.09 ± 321.108), (804.23 ± 163.836), and (852 ± 181.234).

Participants performed a bodyweight squat assessment. Each person had the opportunity to do three repetitions, and the best result was entered into the analyses. We recorded peak force, peak power, concentric and eccentric, all of them expressed in N and W. The instrument used to determine the strength of the squat assessment uses Vlad Performance's Forcedecks tool.

2.3 Statistical Analysis

Descriptive statistics with a t-test examined the distribution of each variable. Results are reported as mean (standard deviation (SD) to indicate peak power, eccentricity, and concentricity during squatting. All analyzes were of SPSS software version 26.0.

3. RESULTS

Table 1 shows that the percentage of male gender (54%) is more than female (46%). The most age was in the range of 26-35 years (59%), and the highest weight was in the range of 51-60 cm (27%).

Table 1. Characteristics of Respondents

Subject Characteristics	n = 41	
	n	%
gender		
man	22	54
woman	19	46
age		
21-25	4	10
26-35	24	59
36-45	10	24
46-60	3	7
Weight		
40-50	3	7
51-60	11	27
61-70	6	15
71-80	10	24
81-90	5	12
91-100	4	10
<101	2	4

Table 2. Result of peak power

	n = 41	Mean	Std. Deviation
Man	22	735.32	375.983
Woman	19	373.63	132.075

Based on the table above, the data shows that with 41 respondents, 21-man respondents (735.32 ± 375.983) had a high average score compared to 19 woman respondents (373.63 ± 132.075).

Table 3. The difference results in the squat assessment

	n = 41			
	Gender		Mean ± SD	p-value
Peak force	Man Woman	22 19	1160.09 ± 321.108 763.35 ± 119.874	0.000
Peak power	Man Woman	22 19	753.32 ± 375.983 373.63 ± 132.075	0.000
Eccentric	Man Woman	22 19	804.23 ± 163.836 584.21 ± 79.209	0.000
Concentric	Man Woman	22 19	852 ± 181.234 612 ± 83.818	0.000

*Significant difference at α<0,05

The results of the independent sample t-test are presented in table 2. The results of the independent sample t-test show p-value <0.05. The highest peak power, peak power, eccentricity, and concentricity occur in males. The results showed that there were significant differences between women and men in the squat assessment.

4. DISCUSSION

Squats are a popular essential multi-joint exercise for lower body performance and strength analysis in various activities, from sports and daily movement characterization to clinics and rehabilitation. [17]. One of the simple exercises can be applied to beginners until an elite athlete is squat. The variation of squat can be setting by progression and regression exercise.

Squats can be attributed to one of the most fundamental movements needed to improve sports performance, reduce the risk of injury, and support physical activity [18]. Squats are performed to strengthen the lower body, including the thighs, hips, and buttocks, which are very important in running and jumping [19]–[21].

The benefits of squats include protecting the anterior cruciate ligament (ACL) and medial collateral ligament (MCL), activation and coactivation of the quadriceps and hamstrings working in opposite directions, resulting in increased muscle strength of the quadriceps-

hamstring force pair, increasing the reaction strength of the patella joint, Which improves the alignment of the patellofemoral joint, which will reduce the incidence of patellofemoral pain syndrome and osteoarthritis [22], [23].

In recent years, interest in analyzing power strength has increased as understanding strength training can impact improving the health, fitness, and performance of children [24]–[26]. Not only in adolescents, strength and power measurements are also performed in adults.

In rugby players, there is a significant gender difference during squat [27]. Squats are also commonly used to evaluate posture and motion stability by analyzing squat movements, ranging from both limbs, pelvis, knees, to ankles. This allows us to know how much of an injury is caused by body imbalance when performing squat movements. For example, the relationship between squat ability and knee ligament injury and hip joint disorder has been [28].

This study is not in line with other studies where the minimum peak force value is 550 N, and the maximum value is 728 N [29], and that gender differences will affect peak power when doing squats [27].

On the other hand, the contribution of intersegmental forces and the net joint moment compared to the knee and hip joints do not have a significant role in the squat movement. However, the ankle and foot position's stability has a vital role in doing the correct squat [30].

Our study found differences in results between men and women during peak force and peak power. After being observed, the difference in these results is because the technique in doing squats is different for each person. The impact of this technique on force production patterns is evident from previous studies where barbell placement was an effect on quadriceps activity, torso tilt, and joint range of movement (ROM) [31].

Our study involved gym members, and peak power and peak force were assessed on the squat exercises. Significant differences were found between men and women in peak force and peak power ($p < 0.05$). Furthermore, the difference in results between men and women was observed as women obtained lower results. This study is in line with other observations that evaluated jumping performance in athletes from different sports and reported imbalances in strength and velocity[32].

This study has several limitations. First, we did not assess strength between the right and left parts of the lower extremities. Second, the current status and previous training experience of the subjects.

5. CONCLUSION

The results of this study indicate strength in lower body extremity when doing squats. Squat, one of the popular exercises in the world, from beginner to elite athletes, can use the squat to reach the goal of training. Besides the exercise, squat can be used for the test of lower-body dynamic. The squat assessment shows performance results when squatting in the form of peak force, concentric peak power, mean eccentric force, concentric mean force. Peak force has two phases, namely the eccentric force and concentric force. Profiling may be valuable for the development of sports-specific programs for lower body dynamics. The coach, athletic trainer, physiotherapist, sports scientist, and doctor can use this information in the design process training programs to maximize fitness development members of a gym, with one goal only, to improve the strength. Future research is expected to see the power imbalance of the right and left lower extremities during the squat exercise.

When doing squats, bodyweight is very influential. This can be seen from the weight of the sample who did squats. The heavier a person's body, the greater the force produced. In addition, gender also affects the force produced by the sample. Regarding age, there is still no in-depth evidence related to this. So it is necessary to do research related to the correlation between the strength generated during the squat assessment and the age of the sample

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